5 DEC 1918

THE

College of Engineering Association Magazine

(Published by G. VENKATACHALAM, B. A.)

Vol. II **November, 1918** **Part I**

CONTENTS

		Page
1.	Editorial— Ourselves	1
2.	War Anniversary	2
3.	Work of the Association— Secretary	3
4.	Our College	4
5.	A plea for extension of Irrigation in India—D. N. Somayajulu	6
6.	Service Reservoirs— R. Sundaram	8
7.	Reservoirs and silt prevention— D. N. Somayajulu	10
8.	Is life worth living?— V. R. Radhakrishnan	11
9.	The structure and seasoning of timber—D. H. Ramachandra Row	13
10.	Wire Ropes—G. Venkatachalam	15
11.	Certain operations of Nature— M. Madhava Row	17
12.	Manufacture of lead pencil— S. S. Visvanathan	19
13.	River Water— S. S. Visvanathan	22
14.	"Engineering Maxima in the United States"	23
15.	Notes and Extracts	25

MADRAS

Price *As. 8*

Commercial Press, Madras, S. E.

OFFICE OF THE ... 5-DEC 1918

THE
College of Engineering Association Magazine

VOL. II. | NOVEMBER, 1918. | PART I.

THE COLLEGE OF ENGINEERING ASSOCIATION MAGAZINE.

OURSELVES.

THE task of voicing forth our ideals and aspirations, of bringing into close contact with one another the past and the present children of our Alma Mater, and of leaving to posterity a true and faithful record of our present day activities, is indeed a noble one, the foundations of which were well and truly laid during the course of last year. It is a trite saying that anything 'well begun is half done ; and I am sure everyone will admit that this noble work has been well begun. Our former editor-in-chief and his able assistants have spared no pains to start the work along right directions, and by their labours have freed their successors from the thousand and one natural obstacles that beset a maiden venture.

It is rather difficult for us who follow so near to them to fully realise the value of their labours. They have done incalculable good not only to the students of this college but to the advancement of our profession as a whole ; for this organ, though humble in its beginnings may probably be the nue cleus of a grand Engineering Magazine. It must be remembered that 'all enterprise of great pith and movement,' have such humble beginnings.

The pleasant duty now devolves on us to continue this noble work where it was left by our predecessors and to see that a fitting superstructure is errected on the solid foundation thus laid by them. It shall be our aim to carefully watch over this rising monument and observe that no eye-offending protruberences are introduced to mar the happy effect. In fact we shall always keep this idea in our mind that there are latent possibilities in our Magazine and that one day it shall burstforth from its narrow and cramped prison in which it is now confined and goforth into the world and take its proper place as one of the leading organs of Engineering Science. We shall devote our earnest endeavour to see that a high standard is kept up for aiming high we often hit high.

But all these would have been mere dreams, and the labours of our predecessors mere waste of energy, if sufficient funds had not been forthcoming in the beginning. Mere enthusism for a cause—and of that they had a super-abundant amount—cannot accomplish everything in this practical world of ours. Money—though sordid was needed to give these.

'Airy nothings a local habitation and a name.'

And at this critical moment came our munificent donors with open purse to help them in their noble endeavour, for

which act of kindness and generosity we offer one and all of them our sincere thanks.

But we cannot always be dependent on the munificence of our donors, and much yet remains to be done to see that our Association and Magazine are established on a financially sound basis. At present we are having as if it were a hand-to-mouth existence. The funds collected in any one year just suffices to meet the expenses of that year. This is not strictly true though, for like good house-holders our predecessors have started the system of leaving a moiety to be carried forward to next year. But this is only a pittance. We should like to see a seperate reserve fund started with the revenues from which we should be able to meet all current items of expense. This too may be only a dream, but a dream in the realization of which lies all our hope for a glorious career for our Association and Magazine.

Let me take this opporunity to appeal to our fellow-students of the junior classes to show a real and sincere interest in our activities. I make this appeal specially to them for in my opinion they have the power to make or mar this glorious undertaking. Scientists tell us that infancy is the period of greatest mortality and hence all loving care is necessary to preserve life during this period. This is a fact true not only of human life but of every creation of God or man. Our endeavours are only in that infant stage and since our junior students will have to be in touch with them and be in charge during this critical period I say that it lies in their power to make or mar our efforts. Further from a purely practical and selfish point of view I believe that among the present students they alone will derive the greatest benefit from this Association. We have had not the opportunity to make the fullest use of our Association because it is only in its infant stage, but they have got ample opportunities. If they would only take this lesson to heart and work for the improvement of our society and its organ, this magazine, then I am sure they will receive the sincere and grateful thanks of posterity for leaving the latter such a rich heritage.

THE WAR ANNIVERSARY.

The 5th of August last was a red-letter day in the annals of our College. On that day was celebrated the fourth Anniversary of the great War. A grand meeting was held in the main Hall at about 1-30 P.M., under the Presidency of our Principal. After a few introductory remarks he called upon M. R. Ry., K. R. Ramaswamy Iyengar Avl., M.A., L.T., to address the meeting. His speech was a noble one most fitting to the occasion. Starting from the prime causes of the War he went on to explain the then position of the Allies at the different Fronts and how taken as a whole they were steadily marchin on towards victory. In this connection it may be interesting to note that his prophetic words have been realised to a remarkable extent during the course of the last few weeks. We have been steadily progressing. In the words of a military onlooker "The whole military situation has been changed. The German army and

nation have passed from a contemplation of victory to a foretaste of final defeat. Germany and her Allies have had a terrible disillusionment. As for ourselves and our Allies, soldiers as well as civilians we at last know that the tide has turned."

Mr. Ramaswamy Iyengar further pointed out how India has helped and is helping to win the War and exhorted us to spare no pains to achieve this glorious end.

The President in his concluding remarks emphasised this aspect of the problem, and said that we students can help to win the War by contributing and making others to contribute to the success of the War Loan, by joining the Indian Defence Force in large numbers and by making people realise that there is absolutely no danger in the use of paper-currency and that all available silver should be handed over to the Government for the successful prosecution of the War.

After the announcement that the afternoon will be a holiday, the meeting dispersed.

WORK OF THE ASSOCIATION CURRENT YEAR.

The first business meeting called for by the late Assistant Secretary, under the Presidency of Mr. S. Krishnaswamy Iyer, M. A., L. T., on the 29th July 1918, made the following election of office-bearers :—

President.

W. H. James Esq., M.Sc. M.I.M E., A.M.I.C.E. F.M.U.

Vice-Presidents.

C. L. Cartwright Esq., A.M.I.C.E., M.I.M.E., M.I.E.E.

H. B. Mathews Esq., M.I.E.E.

H. W. Barker Esq., M.A , M.I.C.E., P.A.S.I.

M. R. Ry., K. R. Ramaswamy Iyengar Avl., M.A.,L.T.

Secretary.

Mr. B. Satyanarayana.

Asst.-Secretary & Treasurer.

Mr. B. Narayana Murthi.

Editor-in-Chief.

Mr. G. Venkatachalam, B. A.

Co-Editors.

Mr. S. Kamesam.

Mr. S. S. Visvanatha Iyer.

The executive committee of the Association to be composed of one member from each class, to be elected by the students of each class.

THE INAUGURAL ADDRESS.

By H. W. Barker Esq., A.M.I.C.E., P.A.S.I.

Delivered on 27th August 1918.

The inaugural address in connection with the College of Engineering Association was delivered on Tuesday the 27th August 1918 by H. W. Barker Esq., Prof. in Civil Engineering on

"Some Notes on Engineering Works For the Mitigation of Malaria."

The lecturer in the course of his interesting and instructive lecture first dealt with the transmission of malaria by mosquitoes, among other agencies and the various sorts of remedies as quinine etc. proposed from time past. The malaria was transmitted from man to mosquito and then from musquito to man and thus the lecturer said there was a regular cycle of operations making it difficult to locate the original birth-place of malaria. He also pointed out that the death-rate was greater among the Indian population than among the European population and in places where it is crowded than in places where it is less dense. The lower death-rate among the European population was explained by the lecturer to be due to the style of dress they wear and the consequent little exposure to the bite of mosquitoes. Then the lecturer dealt with the part played by the Engineer in operations connected with the prevention of malaria as in removing brushwoods and dirt collected on surface of tanks, making arrangements for free passage of air in dwelling-houses, and draining of unwholesome and impure water from tanks etc. He then dealt on the four distinct stages of life of the msoquito and pointed out at what stage it is particularly harmful to man and the measures adopted in combating malaria as the application of quinine, filling in of tanks, oiling of tanks introduction of fish into tanks, etc. The lecturer then dealt with the Anti-malarial works in Madras proposed to be executed under his supervision and careful observation, which unfortunately had to be postponed for want of funds on the one hand and the war on the other. He then dealt with the main and branch channels proposed on the Puruswalkam side of Madras for the complete drainage of storm water, how they are to be uninterrupted in their course, etc.

From the proposals made to combat malaria and the various original investigations made in the construction of the works thereof, one is led to conclude that the author with that practical experience and sagacity required of an Engineer, has made an earnest attempt in the direction of anti malarial operations on the Puruswalkam side of Madras; and we are all grateful to him for the most sanguine ideas he has given to us in that branch of knowledge, in the course of his address.

MADRAS, 1st, Sep. 1918. B. SATYANARAYANA, *Secretary.*

OUR COLLEGE.

Our college is one of the pioneer institutions of its kind in India and as such people who are connected with it or have some interest in its affairs will be looking forward eagerly for its advancement in every direction and the following observations based on the Principal's Administration Report for the year 1917-18, will show the extent to which it has advanced. The year as a whole clearly marks progress in every direction.

The report after dealing first with the usual changes and additions in the Staff goes on to the more important community that of students. Here from a comparison of the number of students admitted during

the year, under review and the previous years,

Year.	Number.
1917—18	526
1916—17	511
1915—16	491
1914—15	429
1913—14	380
1912—13	357

one can clearly see the interest evinced by the Government in the matter of Technical education and it can also be hoped that more attention will be paid to this branch of knowledge after the war. As regards the selection of students from various districts, almost all the districts are represented which only goes to show the interest taken by the people on behalf of Technical education. Formerly this was not the case and one district was represented by a very large number and some others not at all. As regards the various examinations of those who attended almost all passed excepting a few unfortunates in the upper and lower subordinate classes. This high percentage of passes is naturally to be expected from the practical nature of the instruction given. In connection with this Messrs. A. R. Venkatacharya, V. Ramaiya, S. R. Venkateswaran and S. Venkataramanayya as medalists and prize winners are to be congratulated. As regards the survey camps, the various classes encamped this year severally at Thiruneremalai, St. Thomas' Mount and Saidapet at a total cost of Rs. 3,900. In the matters of workshops and laboratories, in the words of the Principal, "We are much hampered in this connection by want of space and paucity of machine tools," and it is also hoped that this "drawback in regard to accommodation will be removed after another year, when we move out to our new premises" and it is also feared that "little will be possible in the way of improving our equipment until the war is over." Yet there is another hopeful note struck by the Principal that "We shall be able to expand our courses of instruction in laboratory and practical work of that kind to include more classes than is feasible at present." To say a word about thenew electrical Engineering laboratory in the Professor's own words, "The instruction in addition to giving a good grounding in fundamental principles, aims at training each student so that he can handle electrical machines and instruments of all types with confidence. With this in view special attention is given to the mechanical construction and values of the electrical and magnetic constants of all types of machines and instruments.

As regards "Visit to works" the classes had been to Cauvery, Godaveri, Pennar, Bombay, etc., and the students had the advantage of practical instruction, but in some cases "owing to the water being high, the undersluices (or any sluice for the matter of that) could not be seen."

Then dealing with the library the Report says "The number of issues to the staff and students were 927 and 2816 respectvely" and so it is a matter of fact that a fourth of the number of books, it may be added, useful books—are taken away by the staff and the inconvenience set up in the way is large. It would be greatly helpful to the students if the members of the staff are kept aloof with a separate library for their own use. As for the College Athletic Club a review has been made already in a previous issue of this magazine

and the club requires still further encourment and support as anything spent in that direction is worth spending. The "College of Engineering Hostel,' again wants sufficient accommodation and "of the 70 members, 44 are resident members and the remainder live outside only taking meals in the College Hostel." The college of Engineering magazine has continued its useful career with a considerable increase in the number of members "and it is hoped that it will have the college and many connected with the Engineering profession itself, among its "number of members" to help it and push it forward. It may also be noted that the Government are spending about Rs. 230 per student while the average tuition fee paid by one student is Rs. 69 per annum.

In conclusion, the Director found it (the Report) and we also find it "interesting and it leaves an impression of a year's varied and strenuous work on which the Principal and staff are to be congratulated."

A PLEA FOR EXTENSION OF IRRIGATION IN INDIA.

With a passing acquaintence with the topographical features of our country with its vast number of villages inhabited by a major portion of the population entirely dependent on agriculture even a stranger is irresistably drawn to the inevitable conclusion that the wealth of the Indian nation is almost primarly dependent on the well being of the agricultural population and it is therefore our bounden duty to provide new irrigation sources where they do not exist and to repair existing ones wherever necessary.

Historical aspect:—The importance of this subject was fully realised centuries, nay ages ago by our fore fathers and the mighty Ruling Houses of Old which resulted in their bequeathing to us a beautiful net work of irrigation storage, reservoirs, large and small which may be counted in tens of thousands spotted throughout the entire length and breadth of the country and also a few system of river channels most of which have either been improved or altered or absorbed into bigger ones by the British Government. If we just imagine and realise the magnitued of the highly specialised establishments maintained by our present day Provincial Government in the shape of Tank restoration scheme parties merely to investigate and systematize the working of existing irrigation works not to speak of the permanent staff maintained for the upkeep by the P.W.D. by the Madras Revenue Department in the shape of Minor Irrigation Establishment and by other local agencies then we may have an idea of the efforts made by our Indian Engineers of old not only to attend to their upkeep but also to evolve fresh schemes with the resources at their disposal in their time. Charity is proverbial of the Indian Nation and not a few of these irrigation sources are the out come of this virtue, the famous Cunbans tank in the Karnool District being an apt illustration whatever may be the causes that contributed to its inception.

Extent of the existing Irrigation:—From a perusal of the report of the Irrigation

Commission of 1901-03 it will be seen that out of the total irrigated area of 44 millions of acres in British India 17 millions are irrigated by canals 13 millions from wells 8 millions from tanks and 6 millions in various other ways. It will thus be seen, that canals and tanks are responsible for a major portion of irrigations of our country. The canal systems are mostly to be seen in the Punjab in the Gangetic valley and in the Southern Presidency. The tanks are generally to be met with to a greater or less extent in almost all the provinces of India including the Native States except in the provinces of Sindh and the Punjab. They are to be found in large numbers in the Shahabad District of Bengal and especially in the Madras Presidency they can be seen in thousands spotted throughout the country. It has been computed that in the Madras Presidency alone there are about 33,000 tanks irrigating to the amount of 3½ millions of acres out of the total irrigated area of 10½ millions thus forming a a substantial proportion of the whole area.

Need and scope for future work:—In spite of the large number of canals and tanks already in existence there is still the urgent need for the construction of more irrigation and storage Reservoirs of varying dimensions and the uninterrupted courses of vaste numbers of streams both large and small present immense possibilities in this direction not to speak of mighty rivers draining this ancient land which when harnessed at other saeient points may still further mitigate the evils attendant upon a precarious rainfall and the present day poverty of our people. Since it is quite apparent nothing more need be said on the necessity for the construction of more irrigation sources which in future should mostly take the shape of storage reservoirs of varying capacities. As regards the scope and the extent of opportunity still open to us, the following figures all give us an approximate idea of the same simultaneously reminding us of the immense efforts required of us in this field of national work before we can make the country inmmune from the ravages of the dreaded famines. Leaving aside the large extent of waste land and forest which are about half the whole area the total average area annually shown in British India is 226 millions acres but the area ordinarily irrigated is only 44 millions of acres forming an average percentage of the latter being as low as 10—9 of the former. In the presidency of Madras the figures are 30½ and 10½ millions of acres respectively the percentage of the irrigated area being 28·8 which is more than the average for the whole country even though not the highest.

By referring to these figures I do not suggest that the remaining area or a major portion of it can be irrigated without limitation with the rain-fall at our disposal but I only point out that a good deal can be done in this direction.

The next thing to consider is the quantity of rain-fall itself available for irrigation purposes, The Indian irrigation commission of 1901-03 has estimated the losses due to evaporation and absorption together with the quantity required for the growth of plant life to be 59 % of the gross rain-fall and that utilized for irrigation to be only 6 % leaving still a balance of 35% that is now being discharged by rivers into the sea. This is only a rough approximation of the actuals chiefly based on probabilities but it is quite evident that a very small percentage of the total rainfall only is at present used for irrigation and

even though there are very great limitations for the full utlization of the remaining 35% of the rain-fall still it cannot be denied that a good amount of work may be done with at least a portion of it for the pressing needs of our agricultural population. I am of opinion that another 6% to 8% of total rain-fall may be made to serve the needs of man which uncontrolled as at present instead of benefitting humanity, sometimes carries death and destruction in tumultuous course to the sea. The ultimate area of irrigated land will thus amount to about 100 milions of acres forming a little less than 45% of the average area shown or a little over one-fifth of the total area of the British Indian Provinces. The capitalised value of the additional area to be dealt with in the future will amount to the huge sum of about 750 crores of rupees but of late we are accustomed to such large figures and need not pause or hesitate due to the amount involved particularly since it is of a productive nature directly remunerative and contributing to the welfare of humanity. In this connection I suggest a well-considered programme may be drawn up spreading the expenditure over a period of say 50 years and the same steadily adhered to.

D. N. SOMAYAJULU,
Assistant Instructor.
20—8—18.

SERVICE RESERVOIRS.

It is very rarely that the water collected from the sources of supply is directly distributed to the town. But the supply of water in an impounding reservoir, or pumped-up from a river or from wells, or collected from springs, is conveyed by an aqudeuct to a service reservoir, su.tably situated near the town to be supplied.

Objects of service reservoirs.—The collection of the supply, water in these service reservoirs not only tends to facilitate the distribution of water by equalising the pressure in the water-mains but also ensures supply for the variable demand during the different periods of the day. Moreover, when the capacity is sufficiently designed, it will be adequate to meet occasional exceptional demand of water, as will be caused by, a large fire, bursting of water-mains, repairs to the acqueduct conducting the water, break down of the pumping machinery or other accident involving a temporary stoppage of supply.

The storage in these reservoirs should never be less than two day's supply but the actual storage must depend on the condition of supply. For example, when the supply is dependent upon a variety of sources a smaller amount of storage will suffice, than when it is dependent on a single source, when conveyed by an aqueduct of considerable length rendering the supply to be entirely cut off during repairs, in which case it might be expedient to store a week's supply or more.

Position of the service reservoir.—The best position for a service reservior is on route between the source of supply and the town to be served, sufficiently near the town for facilitating distribution but not close

enough for the water to be in danger of contamination. Also, the reservoir should be at a sufficient elevation, to deliver water by gravitation to the house-tops at the highest parts of the district. When the area to be supplied varies considerably in level, it is expedient to construct high-level and low-level reservoirs for serving districts situated at different elevations. The arrangement is best suited when the water has to be pumped up into the service reservoirs, as this avoids unnecessary raising of water and does not bring useless pressure on the mains and pipes in the lower parts of the town.

Construction of service reservoirs.—These are usually formed by excavating in the ground or by enclosing them with water-tight embankments or retaining walls and the most economical method is by partial excavation and by the use of the excavated materials to form the embankment above the ground. The embankment to these reservoirs, are the same, but on a smaller scale, as the earthen dams of impounding reservoirs with puddle-wall or masonry core and pitched under-slope. Where space is limited, or materials for water-tight embankments unprocurable, the reservoir is excavated below the surface and lined with retaining walls, thereby utilising the space which would have been occupied by under-slope of the embankment or excavation. It is important to place the inlet and outlet at opposite ends so as to preserve the purity of water by ensuring circulation.

Covered service reservoirs.—The covering of service reservoirs is advantageous especially in the case of water stored from underground supplies, as these contain vegetable-germs whose growth is checked by the exclusion of light. Also the water in large towns requires to be guarded from dust, smoke, fumes and other sources of pollution. This form of protection, though costly, is specially valuable in maintaining the water at a lower temperature in summer and at a higher temperature in winter. These reservoirs should be provided with an automatic valve for cutting off supply when full and a pipe for emptying the reservoir. It is not usually necessary to cover reservoirs in hot countries like ours.

Water towers and elevated tanks.—Sometimes it so happens that no site is available for a service reservoir at a sufficient elevation to provide the requisite pressure for efficient delivery of the supply. In such cases it becomes necessary to raise the reservoir or tank by placing it at an adequate elevation on the highest available ground. Under such circumstances, the cost becomes considerable and hence storage has to be minimised. This is done by delivering the supply to the town direct by pumping under presure, the reservoirs augumenting the supply at times of extra demand and receiving part of the pumped water when there is little demand from the town. Such reservoirs are called Balancing Reservoirs. The one in Kilpauk Water-works of the Madras City is such a reservoir.

These elevated reservoirs are often supported on masonry towers or another usual arrangement being a cylindrical metal tank raised to the requisite height on open, light, trestle-work, composed of a series of standards braced together, with a central supply pipe extending down from the conical or hemispherical base of the tank.

Masonry Service Reservoir.—Occasionally, masonry service reservoirs are used, with one or more floors, being supported and covered over by a series of arches, supported by

several central piers and side walls. Such a reservoir, with only a single floor is our Trichinopoly service reservoir on Rock Fort

R. SUNDARAM.

RESERVOIRS AND SILT PREVENTION.

One of the Engineering problems, which has not received till now, to any appreciable extent, the attention which it so richly deserves is the silting up of tank-beds. Even though a fuller discussion of this subject is not possible within the short compass of this paper, I will endeavour to give a general outline, suggesting therein the means to be adopted for the prevention or the reduction in the accumulation of silt in tank-beds. This accumulation of silt, though it is incidentally beneficial in increasing the retentive capacity of the tank-bed reduces the capacity of the tank itself to a very appreciable extent after a series of years, its rate depending on the nature of the soil and some other physical characteristics of its catchment basin. A barren and rocky catchment basin will deposit the least amount of silt and a well-cultivated one probately the maximum quantity. It may be noted in this connection that the inflow, when it meets the still water in the reservoir, has its velocity reduced to a very considerable extent and consequently deposits heavier particles of silt near the foreshore of the tank, and the lighter ones in the deepest bed near to the centre of the bund. The economical removal of silt by any artificial means is obviously quite impracticable and if it is considered highly desirable to increase the capacity of the tank to meet the needs of its ayacut, recourse should be had to the raising of the crest level of its weir and consequently its bund also. But since it is very economically desirable, to postpone this contingency for as long a period as possible, it is of the utmost importance to adopt practical expedients to reduce the accumulation of silt to the utmost possible limit. But no effort seems to have been made in this direction in many of the provinces of India.

The following measures seem to be effective in my opinion and may be adopted in this connection.

(i) The planting of bushes or aloes in rows across feeding streams in a good number of places whenever practicable to act as silt catchers and thus reduce the amount of silt brought down into the tank.

The construction of grade walls and a small head sluice a little above the point where the stream enters the tank bed, has been suggested to reduce the velocity and the consequent settlement of silt and appears to be a good one, but the action is not automatic in the case of the head sluice.

2. The planting of a row or two of these bushes or aloes all round the tank foreshore also to prevent the carrying down of the silt from the cultivated fields into the tank-bed.

This will reduce the velocity of the inflow into the tank and consequently greater absorption during the time of passage over the fields and consequent reduction in the replenishment of the tank and hence it should not be adopted, in the rare case of

the inflow equalling the required replenishment. Prickly-pears should not be planted in any case, as they spread like a contagion.

3. The provision of topes and pasture lands for a short distance all round the foreshore of the tank for the reduction in the rate of flow of the silt-bearing rain water and the consequent settlement of silt between the roots and the grass blades.

It is a highly unwise act to lease out the foreshore lands for casuarina plantations and similar purposes which require constant tilling and consequent silting up of the tank bed.

4. Giving encouragement to the ryots to take the tank-bed silt for manurial purposes by the provision of good ramps at suitable places for the carts to pass over the tank-bund.

5. Provision of irrigation sluices of large discharging capacity and of sufficient strength with screw gearing shutters to utilise them as scouring sluices during the time the tank surpluses and to provide a diverting channel.

This water may also be passed over the fields as it will carry a certain amount of fertilizing silt from the tank-bed.

6. By diverting the supply channel or the feeding stream so as to make it enter near to or opposite the surplus work so that it may be induced to flow directly over the tank weir and thus carry a major portion of the silt with it without its being deposited in the tank-bed except the finer particles held in suspension which will any how spread throughout the entire water spread.

7. By loosening the tank bed by ploughing so that the silt may easily escape through the scouring or low level sluice during the first freshes. The ryots may be compelled to do this work annually under the Kudimaramuth Act and this will also be an inducement to them to cart away the ploughed sods.

Before concluding this article, it may not be out of place to mention that as a provision against the silting up of the tank-bed, the tank sluices may be designed with high and low level vents each of sufficient discharging capacity so that the former may be utilised when the latter gets unduly silted up.

It is said that the inscriptions on two large tanks in the Chingleput District which have still got a considerable ayacub under them are more than 1100 years old and they may afford a good field for investigation work in connection with the question.

D. N. SOMAYAJULU,
Assistant Instructor.

IS LIFE WORTH LIVING?

The above question has became so hackneyed that it has degenerated into a platitude and a bye-word, that notwithstanding this, at some time or other in every thoughtful person's life the problems of the worth or worthlessness of life must be confronted and a decision arrived at one way or the other. And to-day we have many modern thinkers who have given valuable thoughts on the futility of life and a proper demonstration of it.

There are others, however, of a different temperament, less thoughtful and profound

who in the feverish desire for wealth, power, or position, assert they have discovered the value of life. While in the hurly-burly of life, amid ever-changing activities and excitements, the deep things of existence are neglected and no time is spent in quiet and serious meditation. But a time comes when health fails, friends desert, riches depart, power wanes, and then in the anguish of their heart they ask the question. "Is life worth living ?" Or with another man, the days are spent in intellectual culture scientific, literary, or artistic pursuits, but in the end the same lack of real satisfaction is experienced. Still another says "we are here, and the wisest thing under the circumstances is to bear the ills of life as best as we can, adopting an attitude of indifference or callousness." In the words of the poet:—

> " Live while you live, the epicure would say,
> And seize the pleasures of the present day."

But abiding happiness cannot be found in epicureanism, the pleasures of the senses quickly pall.

Thus while opinions differ, and men are divided as to the rationality or otherwise of existence, the great tragedy of life, the mystery of suffering remains.

To the sensitive soul unsupported by a religion or philosophy of life, the sufferings, calamities and disasters with which humanity is afflicted, or, shall we say cursed, are overwhelmingly depressing. Need we wonder at such a one in answer to the question, "Is life work living ?" giving utterance to an emphatic," No!"

But while admittedly the obverse of the picture is so appallingly real and evident yet happily there is a reverse side with its compensations and consolations. All through the ages, there have come out great religious teachers and leaders to deliver us from sin and suffering, whose good news have been essentially uniform, simple to comprehend but difficult to practise ; not needing an elaborate formula, nor a multiplicity of theological dogmas as vehicles of expression and suitable alike for the orient or the occident, " the same yesterday, to-day, and for ever," and whose message comprised in the term self-remuniciation. As the sage of Chelsea wrote. " It is only with remuniciation, that life properly speaking, can be said to begin."

In the practice of unselfishness, we have a balm for the sorrows and troubles of life, a way of escape from dreaded calamity, which like a Democlean sword threatens us every moment ; a means of transcending all the misfortunes and afflictions that beset us so that we may be enabled to rejoice in tribulation and exult in suffering.

On the one hand we have the fleeting gaieties, of life with its attendant paroxysms of pleasure and pain, sin and suffering, contentment and dissatisfaction, the result of the gratifications of the senses ; on the other hand we have abiding gladness, enduring joy and heavenly peace, the result of self-denial and unselfishness. To the first, life is not worth living, indeed it is not life at all, a blind hopeless existence ; to the second the value of life is increased a thousand fold in the opportunities of service for the good of others. To the question " Is life worth living ?" there can be only one answer to him that lives the life full, abundant, and bountiful, a reply based upon truth and knowledge, upon intention and reason, a decided affirmative.

V. R. RADHAKRISHNAN.

THE STRUCTURE AND SEASONING OF TIMBER.

The Anatomy of wood :—Wood consists of three kinds of elementary organs, which do not however all occur in every species of tree, namely (1) wood-vessels, (2) wood-fibres, and (3) wood-cells.

(1) *Wood-vessels* :—These are more or less narrow tubes closed at their ends which run longitudinally through the stem and branches of the tree. Their walls are thin when compared with their hollow interiors, which appear as pores on transverse sections of wood.

(2) *Wood-fibres* are the chief constituents of wood. They are elongated organs, a few millimeters long, closed at both ends : and their walls are more or less thickened sometimes so much so that their hollow interiors are greatly contracted. Of these, there are three kinds namely (*a*) True wood fibres having very thick walls with small pits on them, (*b*) Tracheids, having thinner walls with large bordered pits on them, and (*c*) Intermediate fibres which resemble true wood-fibres but contain starch and protoplasm.

(3) *Wood-cells* or soft growing tissues, are more or less thinly-walled and isometric cells. They usually have flat ends and are superposed one above the other like bricks in a wall. They contain starch, at least in the younger wood, for the greater part of the year. They are thus the store chambers for reserve nutrient material, while wood-vessels and wood-fibres (of the first two kinds) serve to convey air and watery-sap throughout the plant.

The cambium Layer :—If the bark be separated from the stem of a tree there will be found a layer of slimy mucilaginous matter called the Cambium Layer, which is partly formed bark and partly formed wood, and is the seat of all new-forming wood and new forming bark. In the young stem of most trees, other than palms, the wood-vessels and wood-fibres form fibro-vascular bundles of elongated cells leaving no intercellular spaces ; these bundles first appear as a circle of wedge-shaped masses, on transverse section, by which the stem is divided into a central cellular portion called the Pith, and a peripheral Primary bark : the space between the bundles being occupied by cellular tissues constituting what are known as Pith Rays or Medullary Rays which unite the pith with the bark. These rays consist of woody cells which in winter contain starch. They form bands running radially either from the pith to the bark or originate from some of the latter annual zones and run radially to the bark. The number and size of these rays have much influence on the technical properties of wood.

Annual Rings :—The growth in thickness of wood internally and of the bark externally from the cambium layer ceases periodically and is renewed with each new period of vegetation. Thus the wood and bark are formed in concentric layers each being an annual ring. The rings of wood are formed successively outside and the rings of bark successively inside those pre-existing.

Resin-Ducts :—These are spaces without true walls, surrounded by resin-forming cells. They run not only parallel to the axis of the tree but also pass along the Medullary Rays.

Chemical properties of wood :—The woody-skeleton of trees freshly felled, is chiefly

composed of cellulose and lignin. In the cambium layer the walls of all elements are of cellulose but during the very year of their formation the cell-walls become thickened by layers of lignin which contains more carbon than does cellulose. Cellulose is a soft, flexible, highly hygroscopic material permeable by fluids: cotton-wool is practically pure cellulose. Lignified woody substance is harder, stiffer and less liable to swell by the action of water. Whilst all other ingredients of wood are soluble in caustic alkalies cellulose is insoluble; and advantage of this fact is taken of in the preparation of paper-pulp which in its purest state consists solely of cellulose.

Freshly felled wood contains water in considerable quantity, varying from 30 to 53 per cent of the total weight of wood: it varies with the species, the season, the part of the tree, the locality and various other causes. Air-dried wood, such as has been stored in timber-yards retains only 10 to 11 per cent. of that water. Absolutely dry wood can only be obtained by placing wood in drying chambers at a temperature of 105°c, and it retains that state of dryness only in the drying chamber. Water is absorbed, together with mineral matter by the roots, it is drawn up by the action of the sun on the leaves, chiefly through the cambium layer and juxtaposed on the tissues to the leaves; there the matter undergoes a chemical change by the respiration of the leaves, and it passes down again to the roots in a continually more and more altered form, a continuous circulation passing up and down the living portions of the tree.

The inorganic and organic components of wood comprise chiefly of ash, proteins starches, tannins, colouring matters and resins.

Ash is the residual mineral matter when wood is burnt in air and is abundant in the upper and outer parts of the tree.

Proteins found chiefly in young unlignified wood and especially in the cambium, are rich in nitrogen. Being the most complicated of organic substances, they are the most unstable and readily decompose and consequently become the chief accelerators of decay and rot in wood. Amongst them are included protoplasm and albumen. Protoplasm which lines the interior of the cell-wall is the essential living portion of the cell and it appears that by its joint action with that of the sun, most of the chemical changes, including the conversion of starch into chlorophyll the green colouring matter of plants, are induced in the sap. Albuminoids are a group of substances, containing sulphur as well as nitrogen, carbon, hydrogen and oxygen, always amorphous but capable of existing in two forms, soluble and insoluble. These may be kept when dry for any length of time but when moist they rapidly putrify producing a sickening odour.

Starches or carbo-hydrates are a large class of cognate but distinct compounds of carbon, hydrogen and oxygen, which include besides starch, various forms of sugar, gum and mucilage: they are found chiefly in the cambium and the adjoining sapwood and bark. Starch occurs in minute granules which are only slightly acted on by cold water but under the influence of heat in water, it swells up forming a clouded opalescent paste. Certain complex organic compounds are liable to a peculiar class of metamorphoses called chemical Fermentation: thus starch is liable to ferment into sugar, sugar into alcohol, alcohol into acetic acid and so on. In almost all cases of fermentations of starch and allied matters, the

operation gives rise to the generation of various classes of fungi, *e. g.*, yeast in brewing operations, or what is popularly known as Mildew in most fermentations of starch. Thus, woody-tissues richest in starch are most liable to the attacks of fungi, and also of wood-destroying insects.

Tannius and colouring matters are chiefly found in the bark but are rarely absent from the wood of any species of tree.

Resins, when present in timber increase its hardness and weight, and a certain amount of them increases its elasticity whilst excess renders it brittle.

The seasoning of Timber:—The operation of seasoning comprises two phases :—(1) the speedy elimination, as for as practicable of the proteins aad carbo-hydrates ; and (2) the drying of the moisture content of the timber.

(1) *Elimination of the fermentible material.* It is the opinion of Mr. A. W. Lushington C.I.E. Assistant to the Forest Commissioner, that the importance of this operation has not been sufficiently recoguised in this country. In Tropical countries like India fermentation sets in very rapidly. In fact recent experiments have shown that in unbarked timber "bluing" *i e.*, fermentation and mildew will have set in, in the course of about three days. Fermentation inevitably follows mildew and means the decay and disorganisation of all the organic matter in the wood. Mildew or mould is usually a greenish-blue fungus and it discolours wood. Such deterioration is more pronounced in soft woods than in hard woods. Trees felled and left with their bark on, have their cambium layer enclosed so that no breezes can affect it either by drying it or by cooling it and thus preventing fermentation. The cambium layer being the seat of the proteins and starches and of the chief moisture stratum of the tree there is everything in favour of fermentation and decay rapidly setting in.

(To be concluded.)

WIRE ROPES.

Till about seventy years ago ropes were made only of hemp jute or coir. Improvements in the manufacture of wire have since then brought the metallic rope into great prominence, and have vastly wdened the possibilities of Engineering enterprise. A bar of steel is inflexibility itself, but a steel rope of equivalent strength has sufficient plability to be handled as easily as a hempen rope. Wire ropes are now used for an infinite variety of purposes, for winding and guiding cages in mines, for many large crane tackles, and most important of all for suspension bridges and ærial ropeways. The last mentioned one is a fascinating study by tself since many of them have been constructed in very wild parts of the world and rendered the transport of heavy burdens for miles overland quite an easy affair. Wire rope is also used for marine work, to hold-up masts and rigging, to raise a sunken vessel or tow a floating one. In the form of thin wire it is most useful as fencing, and barbed wire is largely used in the different theatres

of War at the present day as a sort of protection for the army against sudden attacks. Thus taken all round the importance of wire ropes can not be over estimated.

Before the wires are made into strands or ropes they are tested for their quality. A good rope brings in a good reputation and a bad rope probably means an accident. Samples from every coil of wire used and from every completed ropes are submitted to certain tests the passing of which guarantees the perfection of quality. The following are the tests made:—

(1). Torsion test *i. e.*, finding the number of twists the wire can be given before fracture occurs. This shows the toughness of the material. The greater the number of twists necessary the greater is the toughness of the material.

(2). A further test for toughness is made by twisting the wire eight times round a wire of its own diameter and untwisted. If it stands this without breaking its quality is further confirmed.

(3). Tension test, *i. e.*, testing the wire to find its power to resist tension or elongation. This is done by means of any form of testing machine, a description of which is superfluous and need not be attempted here.

The results of all these tests are carefully recorded in a book kept for the purpose for future reference to enable the past history of the rope to be traced with ease.

Wire ropes are composed almost always of six strands twisted together round a core of hemp or other material and each strand consists of a number of wires ranging from six to sixty and odd twisted together either with or without a central care.

The wires after being tested and found to be of good quality are wound on bobbins. From these they pass through holes in the wheel-like end of a frame and are drawn together in a conical form towards the nose' which is the extremity of the frame. Just beyond this is the 'tube' a die which holds the wires sufficiently tight together to allow them to be twisted but permits the strand to move on as it is laid. On leaving the die the strand passes over two grooved wheels geared together and which exert the requisite pull and then on to reels to be wound up.

In the case of a strand with a very large number of wires the process is slightly different. Six wires are made into a strand with a care if necessary and then this strand becomes the central core for a further laying of twelve wires and so on. For making tapered ropes as used in some mines for winding the cages, bobbins are thrown out of action from time to time to diminish the number of wires in each strand.

The strands thus made are converted into ropes in precisely the same manner, only the wheels, bobbins and other machinery are on a correspondingly large size.

The necessity for twisting a number of wires into strands and then these strands into ropes is this :—

If the number of wires in a rope be very numerous the stress on the outside layers will be considerably in excess of that in the interior and hence the strain will be unequally distributed. An ideal rope will have all its wires perfectly parallel to one another. And as a matter of fact, the steel cables used in large suspension bridges are invariably composed of a multitude of small parallel wires clipped together at intervals. But such a rope is impracticable for all ordinary purposes and hence as a compromise, wires are twisted into strands and strands into ropes.

G. VENKATACHALAM.

THE OPERATIONS OF NATURE IN EFFECTING CHANGES IN THE PHYSICAL CONFORMATION OF THE GLOBE.

It requires but little observation and study to discover that every one of the most common and daily operations of nature is concerned more or less in the modification of the crust of the earth. Every shower of rain that falls on a hilly or mountainous district, every brook or river that pursues its course through a greater or less extent of country to the sea, or is swallowed up before reaching the sea, by some mightier stream than its own, every lake or pool, that receives the waters of a river, loaded with particles of muddy soil over which it has passed and poursforth at its opposite extremity a transparent stream, cleared of impurities, every wave that dashes against a projecting rock on the sea coast or washes into a hollow bay, tearing and grinding away the solid cliff;—each one of these, together with other not less powerful though less frequently recurring agents, is concerned in the formation of a new strata and in effecting changes in the physical conformation of the globe.

Of the many constantly recurring phenomena which owing to their perfect and undeviating regularity attract but little notice from the casual observer, there is none perhaps more remarkable than the quantity of solid matter held for a time in mechanical suspension in the water of rivers and brought down to be deposited at the mouth of the stream or spread over the bed of the ocean. This is exemplified by the extensive deltas at the mouths of great rivers such as the Rhine, the Po, the Nile and the Ganges. But the delta of the Ganges far surpasses in magnitude that of any European river; and is perhaps on the whole the most extensive and remarkable of all those at present forming of which we have any accurate data. The head of the Ganges delta commences at a distance of 220 miles in a direct line from the sea and the base of it is 200 miles in length the whole triangular space occupied, comprising upwards 20,000 sq. miles, every part of which has been formed by deposition from the river and its tributaries. The quantity of mud and sand carried by the Ganges into the Bay of Bengal is however, notwithstanding the vast deposit which previously takes place, still so great that during the rainy season when the stream is turbid, the sea does not recover its transparency even at a distance of 60 miles from the coast; and the quantity of mud held in mechanical suspension is so great that a glass of water taken out of the water when at its height, is said to yield one part in four of mud.

The power of water when in motion, of transporting not only mud but heavy bodies of considerable size is another point of paramount interest. This we see when floods occur destroying bridges, roads, crops and buildings. It is said that during flood in one of the rivers in England, a pavement of sandstone rock 14 ft. long, 3 ft. wide and 1 foot thick, and weighing about 4 tons was carried down a distance of 200 yards.

But these effects of running water, important as they may seem are trifling when compared with the quantity of the magnitude of the blocks removed in the

Northern seas and in Alpine districts by the agency of ice and by those masses of frozen snow called glaceires, which form large floating islands by themselves, being sometimes 40 to 50ft. wide and many miles in length, and which are often drifted from the South Pole to the immediate neighbourhood of the Cape of Good Hope. At this instant it may not be out of place to remark of the valiant feat performed by one of the Icebergs in destroying the Great Titanic.

But the power of marine currents and the ceaseless dash of the waves of the ocean are much more striking in their effects than the quiet action of a river. By this, different headlands that stretch into the sea are washed; islands have been separated from the mainland as England is supposed to have been severed from the mainland and islands themselves split as it were into shreds; until at last even these bare bones, the skeleton of what was once land, have also been swept away, the last victims to the restless violence of moving water. In Madras we saw a part of the harbour swallowed up by the waves during the storm of November 1916; and instances might be multiplied, which contend in their destroying tendencies, but space would not permit.

I have all this while been dwelling upon the physical forces, which have only destroying tendencies, without having reproducing sympathies. If this were the case, I may presume that there may come a time when these forces should have done their work completely, leaving no land to wash into mud and no cliff to grind to powder. But examining and observing more minutely, it will not be difficult to discover that an antagonistic force is acting, thus verifying Newton's Third Law of motion, and that the effect of sub-terraneous fire is doing as much to restore and produce inequalities of the surface as the waters of the ocean do to destroy them. The issues of many volcanoes are appalling. In order to understand the real nature and extent of volcanic action, we must not merely direct our attention to one or two of the more remarkable active volcanoes, but taking into account all that is known of the extent and direction of these disturbances of which we have any satisfactory history, bring into one view so far as we can the facts presented to our notice. Now in this small essay it is not possible to state all the instances. So I will pass on giving one or two accounts of interesting facts. Of the many American and Asiatic volcanoes which are dreadful in their effects we have heard of the streams of basaltic lava sent forth through them, flowing for miles and miles around and filling in large cavities, formed in the cliffs and mountains by the constant action of the sea or river water, of the ashes deposited on islands, countries or seas, hundreds of miles away, shutting off for sometime traffic and navigation; and lastly of the general upheaval of land for miles and miles around.

As an instance of volcanic eruption and one extremely remarkable for the extent of its influence, I may give in a few words an account of what took place in the island of Sumbawa (one of the Sunda islands, lying to the east of Java) in the year 1815. The noise of the explosions accompanying this eruption was heard at the distance of 920 miles to the west and 720 miles to the east of the island. The ashes were carried 300 miles in the direction of Java and more than 200 miles northwards towards the Celebes in sufficient quantity to

darken the air; and they were found floating in the oceap to the west of Sumatra, a distance of more than a thousand miles forming a mass of 2 feet thick through which vessels with difficulty forced their way. Vesuvins, the European volcanoe, about half a century afier the birth of Chris t buried the two cities of Herculaneum and Pompei beneath the ashes and mud thrown out of it.

These accounts of a few of the more strik ing phenomena of volcanic action cannot fail to give some notion of the magnitude and extend of the deep-seated disturbing forces incessantly at work, tending to reproduce those irregularities of surface which are destroyed and levelled by the antagonistic force of running water. But it must not be supposed that in every instance where a change of level is produced and a tract of land, elevated or depressed, the change was accompained by an earthquake or occurred in the immediate vicinity of a volcanoe. For there are reasons to believe that there are some disturbing forces slow and gradual by which whole continents may be effected. These can be traced along the whole of southern and western coasts of the British Isles and extend also throughout the north of Europe producing a gradual elevation of the shores of the Baltic.

There are also instances which indicate local depression of the surface as clearly as the raised beaches do local elevation. The beds of vegetable substances occur below the level of the sea and go by the name of submarine forests. In these forests the roots of the trees are found in situations where they originally grew and can often be traced as far as the invest tides. Here the land has suffered a depression since the trees formerly lived on the spot where they are now submerged.

It appears then that an examination of the phenomena of nature with reference to the causes at present in action, tending to modify the crust of the earth introduce us to a series of changes which can hardly fail to astonish those who are in the habit of looking upon the physical features of the globe as permanently and even necessarily fixed.

U. MATHAW RAO.

MANUFACTURE OF LEAD PENCIL.

Of the importance of the pencil, one need not be imformed as it is a material of every day use and with Engineers a material of every hour use. For all appearance, the pencil is very simple, a long piece of lead with a wooden cover, but it is to be noted that the pencil we have on hand is the finished product got through various processes and passing through as many hands as possible. It is not the product of one hand, nor of one machine. The machines used are of different sorts—one for each process and the men employed are many and every man is restricted to one piece of work. As soon as his contribution to the making of the pencil is over he passes it on to his superior for his part of the work on it.

The various processes connected with the manufacture of the pencil fall districtly under two heads. 1. The manufacture of the inside lead itself. 2. The manufacture of outer cover and then the pencil itself.

The manufacture of the inside lead ;—The most important thing in a pencil is the lead and this must be attended to with all care and ingenuity by the manufacturer. The quality of the lead is the thing valued by the public foremost, and of course " the finish " too is an important factor to be attended to. It is a fact generally known that the lead used in lead pencils is of a composition of graphite and clay. But of the exact quality and quantity as well of the ingredients mixed no body has any definite idea; and it is a matter of pure experience and calculation. One might say that from the fact that the pencil has been in use from time immemorial, and that so many good pencils have been produced in the market till now, a definite idea as to the quality and composition of the materials used must have been obtained by this time. But the truth is this—that those makers who were fortunate enough as to get at certain results hold their patents for it and the matter is kept a secret and so it happens that every manufacturer has to perform his own experiments and arrive at results satisfactory to himself and others if possible. So as to the exact composition of the materials themselves, we shall leave it to the patent holders themselves and never think of it until occasion arises. As regards the general process the graphite and clay are separately powdered in a machine. This powdering is necessary only in cases where the graphite ore or clay is in lumps. Otherwise the two can be separtely sieved through a sieve of 100 meshes to the square inch and the sieved products are separately mixed with water in water tight wooden barrels and allowed to settle for some time. After some time, when the sand particles settle down, the clay at a certain consistency is drawn out by pipes attached to the central portion of the barrel and is received in tubs placed round the barrel itself. The same thing is done in another barrel with graphite. This process is only to make the ingredients free from particles of sand—Oftentimes we have felt the presence of a small particle of sand in a lead pencil, more often in pieces of chalk, and the irritation caused by its presence is so great that we sometimes are inclined to break the pencil—This process gone through, the clay with its water is taken to another machine which acts more or less like a filter and the mass is afterwards collected and transferred to the mill where it is finally ground. The graphite which is allowed to settle in the barrel is drawn out and mixed with liquid fuel in which the finer particles of graphite dissolve or float while the heavier particles go down. The mixture is decanted and the decanted liquid evaporated for graphite. This graphite is ground to a fine pasty mass and mixed with the clay in proper proportion in another mill. In this mill are also added colouring matter, borax, soap etc. The product is again transferred to a roller press where the mixture is again ground to the consistency required, and the product from this machine is taken to another machine where it is drawn out likewires of circular or square cross section as the case may be, by bringing pressure to bear upon it. The principle is the same as that in the press used in Hindu houses for preparing a certain class of sweatmeats (சேவை). Now having got these wire-like threads, the manufacturer from their very appearance is able to judge whether the composition is of the required degree and whether the pencil would be good. These wires are drawn out and cut to lengths of 2 ft. and spread on planks of $2\frac{1}{2}$ ft. by 1 ft. and weights in the

form of small chips of wood are placed over these breadthwise preventing any distortion in the process of drying. The leads are then allowed to dry for two or three days. After that period, the leads are cut into lengths of 8 or 9 inches and placed in a fireclay crucible of about the same length and burnt in an oven for a certain period to the required degree. The longer it is heated the harder the lead will be. The leads are then removed and are ready for use in pencils.

Further operations. The next operation in the manufacture of the pencil will be the imbedding of the lead in the wood. The wood used is cedar (got from South East Africa in the case of the Madras Government Pencil Factory) and it is sawn into chips of 8 or 9 inches long 2 inches broad and $\frac{1}{4}$ inch thick. The dimensions are as such that only 5 pencils can be made out of two chips of wood. Now the chips are taken one by one to the machine which makes grooves, on one side only of the chip, to receive the lead. The grooves can be circular, square or rectangular as the case may be, only we have to insert the corresponding dye for the required cross-section. The machine planes it to the proper shape and size before it makes grooves on it. Thus five grooves are made in each chip to receive 5 leads. Now the grooved surface is glued on and the leads five in number are spread in the grooves and another grooved chip is placed just above this one, the grooves of this one just covering the leads in the other. A number of these chips, we shall call them compound chips, are arranged in a press and the two chips which make a compound one are made to adhere well by pressure. These compound chips which have got plane faces now, are then trken to another machine one by one where compound chips with one face plane and the other furrowed and forming semi circular arches are got. This product is then taken to another similar machine from which we get the crude pencil. By crude pencil is meant the pencil which requires further improvements in the way of polishing, colouring etc., before being sent to the market. The crude pencil is first polished in a machine which is specially provided for that purpose. There are two rollers in this machine, one of which is provided with a sand paper and the pencil by some arrangement is made to pass through between these two rollers which when rotated, polish the pencil. The pencil is sent for a second time through the same machine for extra fine polishing. The pencil is now ready for varnishing. The pencil is sent through a small groove over a certain point of which there is a tube containing the colouring matter through which the pencil is drawn out automatically and ejected over two belts placed side by side and moving horizontally. These belts carry the pencils to the other end and there they are collected in a trough. Then the varnished pencils are end—cut by means of a separate machine provided for that purpose, with a polished knife edge, which is itself always sharpened by sand paper. Now the pencils are ready for "printing". If the letters are to be golden ones one half of the pencil is smeared with the "Gold" mixture and the letters impressed by a machine worked by a hand lever. Now the pencils are ready to be packed into dozens and these packed pencils are placed in "Gross" or "half gross" boxes as the care may be with the maker's name and trade mark and the pencils are now ready for the market.

S. S. VISVANATHAN.

RIVER WATER AND ITS PURIFICATION.

In this articale it is proposed to deal with only the various processes involved in the purification of the river water for domestic uses. The several kinds of mechanical filters, and the means by which water is distributed to the houses will not be described in this small article.

Every one is aware that the river is the only infallible and adequate source of supply to large towns and cities; but the objections put forward are many and the engineer has to take care especiatly when he is dealing with a river as a source of supply to a town.

First in cases of towns situated in coasts the rivers may be affected by the tidal action. Therefore it is necessary to draw the water intended to be distributed from those parts of the river which are above the range of the tide,

Them comes the most important aspect of the River water supplies *i.e.* the sanitary aspect. A river in it course takes in as much of dissolved impurities from cultivated lands and inhabited distticts as it can pessibly do not to speak of the sewage that is generally disposed of from big towns and cities. Thus the pollution of river water is always going on and the engineer has to decide how best the water can be purified. Now the question that naturally arises is whether the sewage can be pnrified before being disposed of into the river or whether the polluted water can be purified. From an ecnomoical and also from the sanitary point of view the lotter seems to be the best, for, in the former case the water though free from poisonous sewage matter yet, may contain large amounts of dissolved impurities gathered from cultivated fields etc. The removal of the effects of sewage pollution is done by sand filtration and other sorts of mechanical fitters, for a detailed description of which standard works may be referred to. Incidentally it may be mentioned that in this Presidency the river pollution is not so great as to call for elaborate works connected with it and the filter usually takes the form of a tunnel or drain in the sand upon the banks of the stream and the water which finds its way into these drains becomes purified by the detention of suspended master in the bed of the river from which it is washed away by the action of the stream. For instance the infiltration gallery of the Nellore Water Supply Scheme is about 750 ft. long in the sandy bed of the river and consists of broken stone filling 8 ft. in width taken to a depth of 8 ft. the top of stone filling being 12 ft. below the bed of the river. The water is taken by two lines of stoneware pipes 9" diameter laid at a height of 1 foot from the bottom of stone filling.

After pollution, comes turbidity or muddiness of river water, a factor entirely dependant on the nature of the catchment area. So it may be confidently hoped that a river flowing over a glacial drift of sanday character is less turbid. Again it also depends upon meteorological conditions, a sudden storm may also increase the turbidity. It is to be noted in this connection that the turbidity question is limited only to river waters. Lake and Reservoir waters are only occasionally turbid, and seldom in a way to be seriously troublesome. In dealing with turbitdity reference as to both the quality

and the quantity of the matter must be made. If the particles are coarse-grained and in large amounts, they can be removed by sand filtration and by allowing it to settle for some time in what are known as "settling basins". Sometimes the turbidity is composed of extremely fine grains and the only known way is the addition of a coagulant and the substance usually used is the sulphate of alumina. Then the water treated as such is sent through mechanical filters for further purification.

Next to tnrbidity comes colour which is simply due to the presence of organic matter extracted from dead leaves etc., and colour is to be distinguished from turbidity which results from clay and other suspended matter. This colour is removed to a very great extent by the sulphate of alumina treatment.

In conclusion, there are no tastes and odours in river waters as in the case of well and reservoir waters and as such they do not call for the attention of the Engineer and as a whole the river water treated for the particulars given above may be safely recommendcd for Domestic uses.

S. S. VISWANATHAN.

BNGINEERING MAXIMA IN THE UNITED STATES.

Railroad Bridges:—The longest span is the cantilever bridge over the St. Lawrence River, near Quebec. The spans are 515,1800 and 515 feet. It contains 63,000 tons of steel. The next largest single span, but the longest if the bridge approaches are included, is the one over Hell Gate, New york city: the total length with approaches (some of which are stone arches) is 18,130 feet and it contains 87,000 tons of steel. The longest single span is 1000 feet. The longest single structure steel bridge is probably the one at Kansas, city which is $1\frac{3}{4}$ miles long.

Steam Locomotive.—The largest and most powerful steam freight locomotive ever constructed is the articulated Erie Triplex built by the Baldwin Locomotive works. It has 12 pairs of driving wheels four of which are under the tender besides two-wheel leading and trailing trucks. The total wheel base is 90 feet and it weighs with the Engine and tender in working order 853,050 pounds or about 426·5 short tons. It has a tractive force of 160,000 pounds when working compound. The tender has a water capacity of 10,000 gallons and a coal capacity of 16 tons.

Electric Locomotive.—The largest electric passenger locomotives are those operated on the Chicago, Milvawkee and St. Paul Railway, developing 3440 H. P. each or 3000 continuously, measuring 112′8″ over all and having a tractive force of 800 tons over all grades up to 2 per cent. On a level track they will also haul the same tonnage at a speed of 60 miles per hour. The largest electric freight locomotives of the same railroad have a capacity to haul 3000 tons up a 1% grade at 15·5 miles per hour, or the same load on a level track at about 30 miles per hour. The largest freight locomotives on the Norfolk and Western line are the single

—phase—three—phase, consisting of two sections, weighing together 540,000 pounds and having a motor capacity of 2400 H. P. and a tractive force of abont 135000 pounds at 14 miles per hour.

Trains.—The longest freight trains in regular use are believed to be those on the Erie Railroad, consisting of 80 to 90 cars weighing about 70 tons each. The total length is about 3400 feet or about ⅔ of a mile. A test train of 251 loaded cars of a total weight of 17612 short tons back of the tender and a length of 8547 feet or about 1·6 miles was pulled by this locomotive, but this is not regular practice.

The longest passenger train run oocasionally in commercial service on the Pennsylvania railroad has 16 cars of 60 tons each, and a locomotive weighing 200 tons. The longest one run regularly has 12 cars. The longest freight train on that road has 135 cars of 70 tons each when loaded and a locomotive of 220 tons.

Central Stations.—Among the largest are that of the Common-wealth—Edison Co. chicago; approximately 310,000 K. W. generated by steam. The two New York Edison Stations approximating 280,000 K. W. also steam driven. The Mississippi River Power Co. has at present 135,000 K. W. installed, with an ultimate capacity of 270,000 K. W. generated by water power. The Philadelphia Electric Co. has approximately 162000 K. W. installed all generated by steam. The Niagara Falls Power Co. operates 67,000 kilo watts in three different plants. These central stations are not always entirely under the same roof, but when under separate roofs they are interconnected electrically, forming one system. Of these, the largest one furnishing city service is the Common wealth Edison Co., with the New York stations next and the Philadelphina stations probably third.

Electric Transmission—The longest distance is 275 miles at 150,000 volts (nominal) on the system of the Pacific Light and Power Co. in California.

Voltage.—The highest voltage used in transmission is 1 0,000 volts nominal, (actually148,000), on the Y—connected transformers of the Pacific Light and Power Co. California.

Generator.—The largest single Electric generator is 47,000 K. W. which is to be installed in the near future at the Duquesne Light Company's plant in Piltsburgh. The largest now instelled is the 35000 K. W. unit at the Philadelphia Electric Company's plant.

Are lamps.—The largest in regular use for lighting is a flaming arc of 12·5 ampers, 110 volts, and for flood lighting as high as 100 ampers at 110 volts; for photographic purposes as high as 30 ampers at 110 volts; for etching glass 95 to 150 ampers at 110 volts; for searchlights 200 ampers.

Incandescent lamps. The largest made commercially is a 2500 watt lamp. Larger ones of possibly 4000 to 5000 watts have been made, but not commercially.

Telephony.—The longest distance to which Telephony over-wires has been carried out is from New York to San Fransisco, by way of Boston, Buffalo, Chicago, Denver, Salt Lake City and Portland (Oregon), a total length of circuit of over 4700 miles. About ten telephone relay or repeater stations were used.

Buildings.—The highest office building in the world is the Wcol worth building in New York City which is 750 feet high to the observation platform, the lantern being 42 feet higher. The largest in area is the Equitable Building in New York City, having a total floor space of 1 200,000 sq. ft. nearly 1/20 of a square mile or 27 areas.

SCIENTIFIC AMERICAN,
June, 24th 1916.

NOTES AND EXTRACTS.

"A New Terrace Proof."

The Terrace roof meant is the Subramani Iyer's patent which consists of slabs of brick clay 3″ thick with a rebate all round and $13\frac{1}{2}$ by 12 inches which are dropped into openings 10″ by 12″ made by letting the reapers flush into the rafters by cutting the rafters to the thickness of the reaper. For the success of this roof, The Indian Textile Journal writes that two things must be understood a non-alsorbent surface and the necessary amount of elasticity ; and it adds that "a remedy has been found in elastic joints like those of the planks on a ship's deck and that there are now preparations that render brick surfaces completely non-absorbent." Yet the additional labour involved in cutting the rafters to receive the reapers is apoint against it; anyhow its comparative lightness over the heavy Madras Terrace is a point strongly in favour of it and every attempt must be made to popularise the new terrace.

Concrete Machine Tools.

Of the many ways in which the war has been indirectly helping us, one is in the direction of the manufacture of big machinery, which otherwise would not have seen the light of day. For instance according to the latest news supplied by the Scientific American, "the first of the newly invented machines is a planer of record breaking size. The second is a machine for boring big guns of any size or length. The planer was designed especially for producing the boring machines and is a radical departure from anything hitherto attempted in the machine tool line......The planer is built of concrete and iron and is the first machine of its kind that has ever been built of that combination. It is also the biggest planing machine in the world." Of the two machines that are now completed "each planer weights about 2,500,000 lbs. and contains approximately 212,000 pound of iron and steel casings and 13,500 cubic ft, of concrete reinforced with 34000 pounds of steel bars. The bed of the planer was designed like a huge concrete girder intended to support a load, which accounts for the high percentage of steel reinforcement. This was done to avoid any possibility that the bed might settle at any point and destroy the alinement of the ways. On the bed of the planer there is a sliding platen, which moves in iron grooves. The plate weighs 69 tons and upon it is placed the work that is to be planed, two heavy travelling cranes being used for the latter purpose."

The above simply shows one of the various ways in which reinforced concrete is used and it may also be confidently hoped that the subject ferro-concrete would he studied and investigated in future to a very large extent.

Obituary.

Since going to print we have received news of the untimely death of Mr. B. L. Ramnath, our former Editor-in-chief. It is indeed lamentable to note the passing away of such young men, who are just ready to enter the arena of life and grapple with its problems. Mr. Ramnath was a Mysore student, and hence had been entertained in that State as soon as his course in the College had, finished. Thus he had but just entered on the race course of life before he was snatched away from our midst by the unrelenting hand of Death. But his name shall ever be remembered as the first editor of our Magazine, and a fitting method of cherishing his memory shall be to bring this magazine to better prominence by working along the lines he has indicated.

RECEPTION TO THE ENGINEERING GRADUATES.

This year's reception to the Engineering Graduates attending the ensuing Convocation will be given by the students of the College of Engineering under the auspices of the College of Engineering Association on Saturday the 23rd November 1918.

C. N. SHAMAROW,

Hon. Secretary, Reception Committee.

NATIONAL BANK of INDIA, Ltd.

(INCORPORATED IN THE UNITED KINGDOM).

Bankers to the Government in Kenya and Uganda.

Subscribed Capital	**£ 4,000,000**
Paid-up Capital	**£ 2,000,000**
Reserve Fund	**£ 2,200,000**

HEAD OFFICE:

26, Bishopsgate, London, E. C. 2.

BRANCHES:

INDIA - Calcutta, Bombay, Madras, Karachi, Lahore, Amritsar, Delhi, Cawnpore, Chittagong, Tuticorin & Cochin.

CEYLON - Colombo, Kandy & Nuwara Eliya.

BURMAH Rangoon and Mandalay.

ARABIA,- Aden and Steamer Point Aden.

ZANZIBAR.

KENYA - Mombasa, Nairobi, Nakuru, Kisumu.

UGANDA Entebbe, Kampala, Jinja.

TANGANYIKA Dar-es-salaam, Tanga.

AGENTS IN NEW YORK, and in the principal cities of America, Africa, Australia & Canada

CURRENT DEPOSIT ACCOUNTS

Interest allowed at present at the rate of one per cent. per annum on daily balances from Rs. 1,000 to Rs. 1,00,000 but no interest is allowed if it amounts to less than Rs. 5 for six months.

FIXED DEPOSITS

Fixed Deposits received on terms that may be ascertained on application.

GENERAL BUSINESS

Bills of Exchange negotiated and collected and Letters of Credit and Drafts granted on the Bank's London Office and Branches and on Agents. Letters of Credit are issued encashable at any of the important Towns in British India.

The Bank undertakes the purchase and sale of Government Securities, and Stocks and Shares on behalf of its constituents. Trustee and Executorship business is undertaken by the Bank's London Office.

Madras Office:
(Post Box No. 54)
National Bank Buildings, North Beach,
MADRAS.

A. H. WHELAN,
ACCTT. IN CHARGE.

news
Of Vital Interest To INDIA!

FAMOUS **'FIRE & GENERAL'** INSURANCE COMPANY

NOW OFFERS

LIFE INSURANCE

TO SUIT EVERY NEED AND PURSE!

The Directors and Managing Agents—Messrs. M. Kanji & Co., of The Universal Fire and General Insurance Co., Ltd., beg to announce the opening of a ***LIFE DEPARTMENT***—to commence from 19th February, 1936.

Since 1919, ***"The Universal"*** has covered every form of insurance business, except that of ***LIFE*** insurance. Thousands of Indians have covered their properties with this famous Company knowing that their interests are perfectly safe. And also because they appreciate the prompt way in which claims are paid by ***"The Universal."***

Write to the ***LIFE DEPARTMENT,*** to-day—learn of the many attractive and beneficial policies which are offered.

The
UNIVERSAL
FIRE AND GENERAL
INSURANCE COMPANY LIMITED
(INCORPORATED IN INDIA)

Authorised Capital	Rs.	1,00,00,000
Issued Capital ...	Rs.	1,00,00,000
Subscribed Capital	Rs.	54,78,300
Paid up ,, ...	Rs.	6,34,900

Telegrams: **"KOTHARI".**

Chief Agents for Madras Presidency:—

KOTHARI & SONS,

POST BOX No. 267.

42, Broadway, :: :: MADRAS.

Telephone **3909** (2 *Lines*)

CHARTERED BANK

OF INDIA, AUSTRALIA & CHINA

(INCORPORATED IN ENGLAND BY ROYAL CHARTER, 1853).

Capital : : :	**£ 3,000,000**
Reserve Fund : : :	**£ 3,000,000**
Reserve Liability of Proprietors :	**£ 3,000,000**

Head Office:

38, Bishopsgate, London, E.C. 2.

BRANCHES:

Alor Star (Kedah)
Amritsar
Bangkok
Batavia
Bombay
Calcutta
Canton
Cawnpore
Cebu
Colombo
Delhi
Haiphong
Hamburg
Hankow
Harbin
Hongkong
Iloilo
Ipoh (F.M.S.)
Karachi
Klang (F.M.S.)
Kobe
Kuala Lumpur
Kuching (Sarawak)
Madras
Manila
Medan (Sumatra)
New York
Peiping
Penang
Rangoon
Saigon
Semarang
Seremban (F.M.S.)
Shanghai
Singapore
Sitiawan (F.M.S.)
Sourabaya
Taiping (F.M.S.)
Tientsin
Tongkah (Bhuket)
Tsingtao (N China)
Yokohama
Zamboanga (P. I.)

CURRENT DEPOSIT ACCOUNTS opened and **FIXED DEPOSITS** received on terms which may be ascertained on application.

The Bank Issues Letters of Credit and conducts every description of Banking and Exchange business with all the principal cities of the world.

The London Office of the Bank undertakes Trustee business and Executorships.

R. W. MORRIS,

Madras Agency : **Esplanade.** *Agent.*

FOR BEST VALUE IN LIFE, FIRE & MOTOR-CAR INSURANCE PROTECTION

INSURE WITH

THE INDIAN GLOBE INSURANCE COMPANY LTD.

HEAD OFFICE — BOMBAY INDIA

FOR FIRE MARINE LIFE & ACCIDENT

INCORPORATED IN INDIA

(A PURELY INDIAN INSURANCE COMPANY)

It offers Up-to-date plans to Policy-holders and
BEST TERMS to Agents.

Chairman :—MATHURADAS VISSANJI KHIMJI, Esq., J. P.,
Merchant and Mill Owner.

Managing Agents :—Messrs. VIJAYASINGH GOVINDJI & Co.

UNIQUE FEATURES ARE :—

1. Absolute Security.
2. Very low Rates of Premium.
3. Unrestricted policy.
4. Best Surrender Values.
5. Automatic Non-forfeiture.
6. Extended Assurance.
7. Prompt and generous SETTLEMENT OF CLAIMS and Courteous Treatment.

WANTED AGENTS

in all Districts. on most Liberal terms of Commission and Salary.

Apply Immediately to :—

KOTHARI & SONS,
Chief Agents for Madras Presidency :
42, BROADWAY, MADRAS.

Telephone **3909** (2 *Lines*)

THE BANK OF MYSORE, LTD.

(Bankers to the Govt. of H. H. THE MAHARAJA OF MYSORE.)

Telegraphic Address: "MYSORE BANK." *Telephone No.* 393.

Authorised Capital	...	...	**Rs. 20,00,000**
Subscribed and Paid up	...	...	**" 20,00,000**
Reserve Funds ...	...	...	**" 24,25,000**

Head Office:

Avenue Road, BANGALORE CITY.

Branches:

Arsikere
Channapatna
Chickballapur
Chickmagalur
Chintamani
Chitaldroog
C. & M. Station (Bangalore)
Davangere
Harihar
Hassan
Kolar
Mysore
Oorgaum
Sagar
Shimoga
Tiptur
Tumkur

London Agents: THE EASTERN BANK, LTD.

Chairman of the Board of Directors:

Sir K. P. PUTTANNA CHETTY, Kt., C. I. E.

CURRENT ACCOUNTS opened and interest allowed at 1 per cent. per annum up to **Rs. 10,000.**

LOANS & CASH CREDITS are granted on approved Securities.

FIXED DEPOSITS for Six and Twelve months received at rates which may be ascertained on application.

THRIFT DEPOSIT A/Cs. are opened and interest allowed at 2½ per cent. per annum up to **Rs. 2,500.**

BANKING BUSINESS of every Description transacted on Terms which may be ascertained on Application.

P. W. O'BRIEN,
Manager.

Established in 1906, the Ideal of this LIFE OFFICE have always been

FAIR-DEALING

AND

FINANCIAL STABILITY

Total Business in Force Exceeds - -	Rs. 10,00,00,000
Total Assets Exceed - - - -	,, 2,70,00,000

NATIONAL INSURANCE Company, Limited.

Haad Office :

NATIONAL INSURANCE BUILDING

7, COUNCIL HOUSE STREET

CALCUTTA

Branches :

BOMBAY, MADRAS, DELHI, LAHORE, RAWALPINDI, PATNA, RANGOON AND KUALA LUMPUR (F.M.S.)

Sub and Agency Offices at

Ahmedabad	Dacca	Jessore	Raipur
Allahabad	Dehra Dun	Madura	Serampore
Bangalore	Gauhati	Mbale	Surat
Burdwan	Gwalior	Nagpur	Sylhet
Colombo	Jamshedpur	Nairobi (B.E. Africa)	

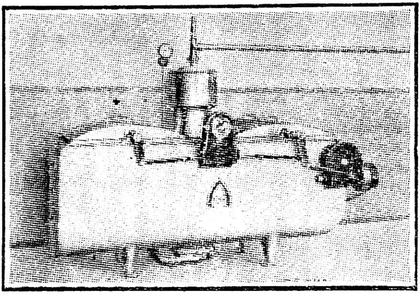
FIRE AND MOTOR RISKS

Undertaken by our Subsidiary

National Fire & General Insurance Co., Ltd.

HEAD OFFICE :

CALCUTTA



FOR MODERN DAIRY MACHINERY

Send enquiries to :—

THE INDIAN GENERAL TRADING CO., LTD.,

Goa St. **BOMBAY** **Post Box 332**

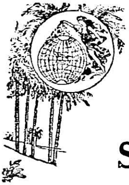
MANY INTERESTING PUBLICATIONS ON AGRICULTURE & INDUSTRY

Have been issued.

Apply For Free List :

In India :—To MANAGER, CENTRAL PUBLICATION BRANCH, Post Box 2078, CALCUTTA.

In Europe & U. S. A. :—To Secy. To HIGH COMMISSIONER FOR INDIA, ALDWYCH, LONDON.



Sutton & Sons

READING, ENGLAND

SEEDSMEN

TO

H. M. THE KING-EMPEROR

THE INDIAN EMPIRE

The Whole World

HIGH-GRADE SEEDS FOR GARDEN & FARM

Pedigree stocks imported from Reading, also country vegetable seeds grown under supervision always available at

SUTTON & SONS

INDIAN BRANCH

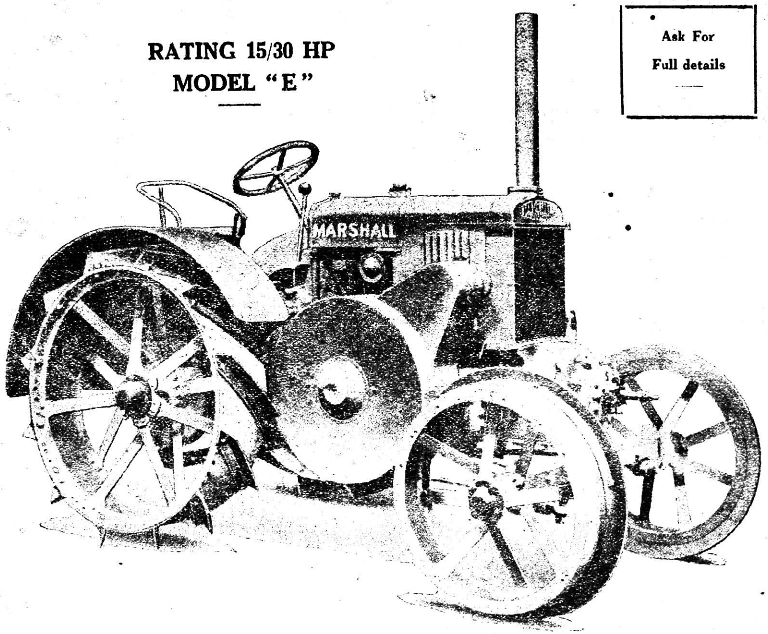
35 & 36, Park Mansions, CALCUTTA.

When writing please refer to this Advert.

MARSHALL DIESEL TRACTOR.

RATING 15/30 HP
MODEL "E"

Ask For
Full details



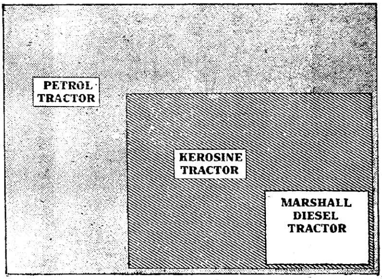
Uses heavy oil far cheaper than Petrol in price and cuts down ploughing costs astoundingly.

Ask for our detailed Specifications and Prices.

MARSHALL SONS & Co. (India) Ld.
ENGINEERS.

CALCUTTA, BOMBAY, KARACHI, LAHORE, MADRAS, BEZWADA, TANJORE, COIMBATORE.

Agents in
Rangoon:
FAIRWEATHER RICHARDS & CO. LD.



Runs at about ½ the cost of Kerosene.

Their hopes and aspirations... your responsibility

Invest in Central Bank's MONEY MULTIPLIER DEPOSIT SCHEME

Rs. 5,000 becomes Rs. 10,040 (app) in 7 years and Rs. 13,536 (app) in 10 years

Final Amount Repayable				
	Period			
Deposit	12 Months	36 Months	61 Months	120 Months
Rs.	Rs.	Rs.	Rs	Rs
500	541.50	654.32	829.51	1,353.52
1,000	1,083.00	1,308.64	1,659.02	2,707.04
2,000	2,166.00	2,617.28	3,318.04	5,414.08
3,000	3,249.00	3,925.92	4,977.06	8,121.12
4,000	4,332.00	5,234.56	6,636.08	10,828.16
5,000	5,415.00	6,543.20	8,295.10	13,535.20
10,000	10,830.00	13,086.40	16,590.20	27,070.40

Central Bank of India

(A Government of India undertaking)

The Bank that moves out to people and places

CBI-232-76-A

With best compliments from:

NAV BHARAT CORPORATION

Licensed Custom House Agents
Clearing, Forwarding, Shipping & Warehousing Agents

For various Govt. Projects, Banks, Commercial Houses
and D.G.S. & D.

NAV JEEVAN AGENCIES
Ships & Warehousing Agents

NAV BHARAT CLEARING AGENTS PVT. LTD.
Clearing & Forwarding Agents

REX CHAMBERS, 4th Floor
WALCHAND HIRACHAND MARG
BALLARD ESTATE
BOMBAY - 400 038

Phones: 264081 / 4
Grams: DELICATE
Telex: 011 - 3513

SARADA

DIESEL ENGINES & PUMP SETS for
AGRICULTURE & INDUSTRY
SD-2, SBHP RPM - 1500

Successfully Tested at

NATIONAL TEST HOUSE, ALIPUR, CALCUTTA
Conforms to ISI Specifications No. 1601 - 1960

For Further Details Contact Manufacturers.

SARADA ENGINEERING COMPANY
B 6 & 7 Industrial Estate,
Moulali, HYDERABAD - 40 (India)

Phone No: 71543
Grams: SECDIESEL

MORE & MORE LAND UNDER IRRIGATION

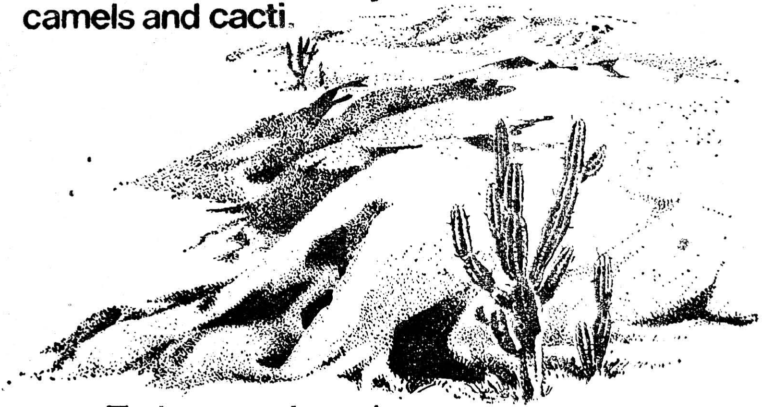
The need of the hour is to make maximum utilisation of the Nation's water resourses to increase food production. Lift irrigation schemes thus are a 'must' in this programme.

The Government of Maharashtra has established the Irrigation Development Corporation Ltd., which has during the last two years, launched more than 300 lift irrigation schemes and thus provided for an addition of 1.8 lakh metric tons of food production

Lift irrigation is the sure way to agricultural prosperity.

The Director General of Information & Public Relations
Government of Maharashtra, Bombay

Time was,
when deserts were fit only for
camels and cacti.



Today, canals and
chemical fertilizers turn even the
most arid land into a
profitable agricultural investment.

IEL explosives help irrigate the land, IEL fertilizer makes it productive.

Once, desert land was considered dead land. But not any more. Today's technology can harness natural forces to work for us, not against us. Modern scientific methods of cultivation and irrigation have made the term "non-arable" obsolete, have made deserts fruitful.

IEL 'Torch Brand' explosives have helped to build canals, wells, dams, reservoirs which irrigate former waste lands. IEL 'Chand Chaap' Urea fertilizer reconditions the poorest soil Crops increase in quantity, improve in quality. IEL's Farm Advisory Service helps to solve agronomic problems.

IEL
'TORCH BRAND' EXPLOSIVES

IEL
'CHAND CHAAP' UREA FERTILIZER

INDIAN EXPLOSIVES LTD.
Regd. Office:
34 Chowringhee, Calcutta 700071

IEL 8930

KALPAKA TRANSPORT CO. (PVT) LTD.

FLEET OWNERS AND TRANSPORT CONTRACTORS

(Regd. Office: **CALICUT-1**)

★

SPEED—SAFETY AND PROFIT TOO

THE PREMIER HOUSE OF ROAD TRANSPORT IN THE SERVICE OF THE COUNTRY

PLYING SCHEDULED SERVICE TO ALL OVER INDIA

★

Specially to :

BOMBAY — BANGALORE — CALCUTTA — AHMEDABAD — DELHI — MADRAS — HYDERABAD — GOA — NAGPUR — KANPUR — LUDHIANA — JULLUNDUR — INDORE — GAUHATI — PATNA — JAIPUR Etc.

1/70, 2/70 Broadway,
MADRAS - 600 001.

Phone : { 20332 20333   Telex : 041-7153

★

BRANCHES AND AGENCY OFFICES THROUGHOUT INDIA

MILLIONS RELY ON US. : : WHY NOT YOU?

K. T. C. (P) LTD.

STRIKING
THE RIGHT
CHORD

DUNLOP INDIA
has been in harmony, striking the right chord in the country's industrial development. In the service of India's transport, industry, agriculture, defence and exports.

DUNLOP INDIA
keeping pace with progress.

DPRC-80

CUMMINS
MEANS
POWER

We offer world famous
and most dependable
CUMMINS DIESEL ENGINES
in 60 to 1600 HP Range
for Earthmoving, Construction,
Marine and Industrial
Applications and also for
POWER GENERATION

KIRLOSKAR CUMMINS LIMITED

Kothrud, POONA - 411 029.

Here are monuments and Sculpture unsurpassed by any standard. Take for instance SUN TEMPLE at Modhera-the symbol of super craftsmanship of the Gujarat architects Constructed during the reign of Bhimdeva I (1026-27 AD). It's nothing but a marvel in stones.....a rare relic of once magnificent monument where deftly carved out divine and human figures provide a spiritual synthesis between Heaven and Earth.

And the GIR-the roaring land of Lions—the only natural home of lions in Asia....the pride and glory of Gujarat. To see them in their natural environment from a shake hand distance without any barricade is a lifetime thrilling experience.

SHAKING MINERATES :

The historical City of Ahmedabad can be proud of its unique contribution to art and architecture in its varied forms. One of the most interesting popular monuments in Ahmedabad is a mosque called Sidi Bashir's mosque-quaintly known as the mosque with shaking minerates. Girded by delicate carved stone balconies, each minerate has three storeys. When one minerate is shaken, the vibration is communicated to the other via the stone bridge joining both.

The architecture of Shaking minerates is unique, not found anywhere. The minerates have withstood ravages of four centuries.

WELCOME TO GUJARAT

RENOWNED FOR ITS RICH CULTURAL AND ARCHAEOLOGICAL HERITAGE TRACING BACK TO THE HARAPPAN CIVILIZATION, ITS LIONS & WILDLIFE

DIRECTOR OF TOURISM GOVT. OF GUJARAT

Phone
GANDHINAGAR 2211, PBX 479
AHMEDABAD 24726
JUNAGADH 834
NEW DELHI 343173
BOMBAY 257039

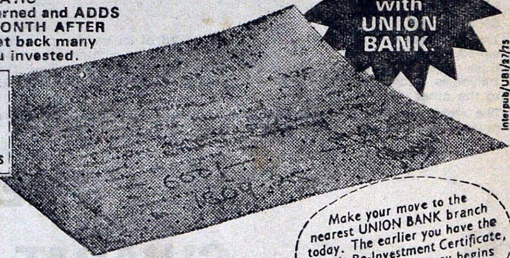
Money Grows Many-Fold on

UNION BANK

DEPOSIT RE-INVESTMENT CERTIFICATES

This scheme gives you AUTOMATIC RE-INVESTMENT of interest earned and ADDS to your capital progressively MONTH AFTER MONTH. In the process, you get back many times the amount of money you invested.

YOUR MONEY multiplies with UNION BANK.



FOR A RE-INVESTMENT CERTIFICATE OF RS. 600/- YOU GET:

★ in 84 months Rs. 1,284.75 over DOUBLE
★ in 111 months Rs. 1,567.00 over TWO AND A HALF TIMES
★ in 133 months Rs. 1,809.25 over THREE TIMES

★ Wide range of choice of Certificates for denominations of Rs. 600/- and its multiples for 62, 84, 111, 133, 168, 194, 216 and 235 months.

★ For contingencies, provisions for a loan or premature encashment.

★ ALSO, tax benefits year after year available under the Income-Tax and Wealth-Tax Rules.

Make your move to the nearest UNION BANK branch today. The earlier you have the Deposit Re-Investment Certificate, the sooner your money begins to grow and grow.

We Help You Help Yourself

UNION BANK OF INDIA

(A Government of India Undertaking)

Interpub/UBI/27/75

WITH BEST COMPLIMENTS FROM

SYNBIOTICS LIMITED

Post Box No. 129

WADI WADI

BARODA-7.

❋

Manufacturers of

BULK ANTIBIOTICS, VITAMINS & FINE CHEMICALS